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B8A
B8C
Selected US specifications from IPC sub-class B65G

(54) Sensing groups of cigarettes on a conveyor

(57) On a conveyor leading to a cigarette packing machine, the presence and completeness of the cigarettes (4) forming a group (3) of cigarettes are sensed by a number of pin feelers (18) equal in number to the cigarettes (4) in the group (3) and each designed to traverse axially to and from one end of a respective cigarette (4) in the group (3), between an operating position, wherein the pin (18) contacts the respective cigarette (4), and a idle position; each pin (18) being connected to a sensor (25) designed to emit control signals as a function of the position of the respective pin (18) subsequent to moving into both the operating and idle positions. The sensors 25 thus operate to stop the machine if a pin (18) fails to contract a cigarette due to absence of the cigarette, absence of filter or incomplete filling, and also to stop the machine if a pin (18) fails to return to its correct idle position.

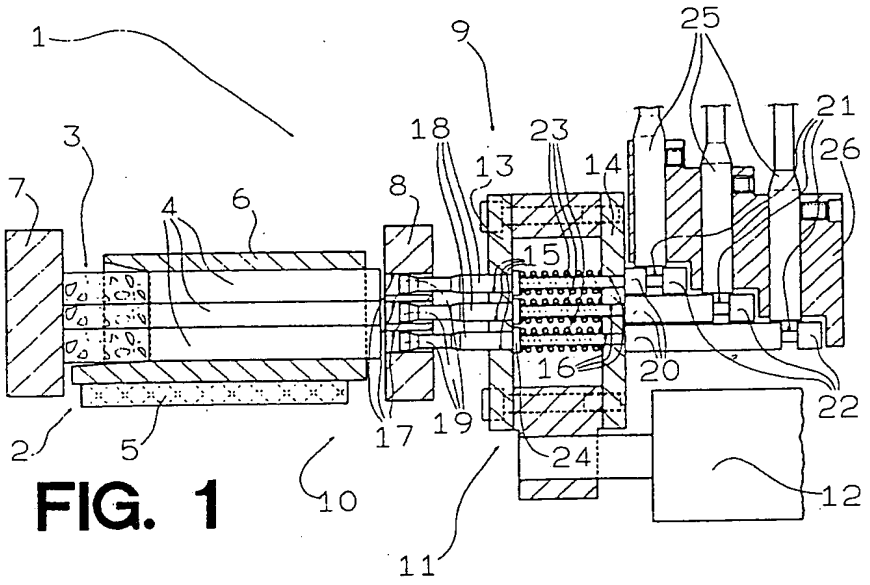

FIG. 1

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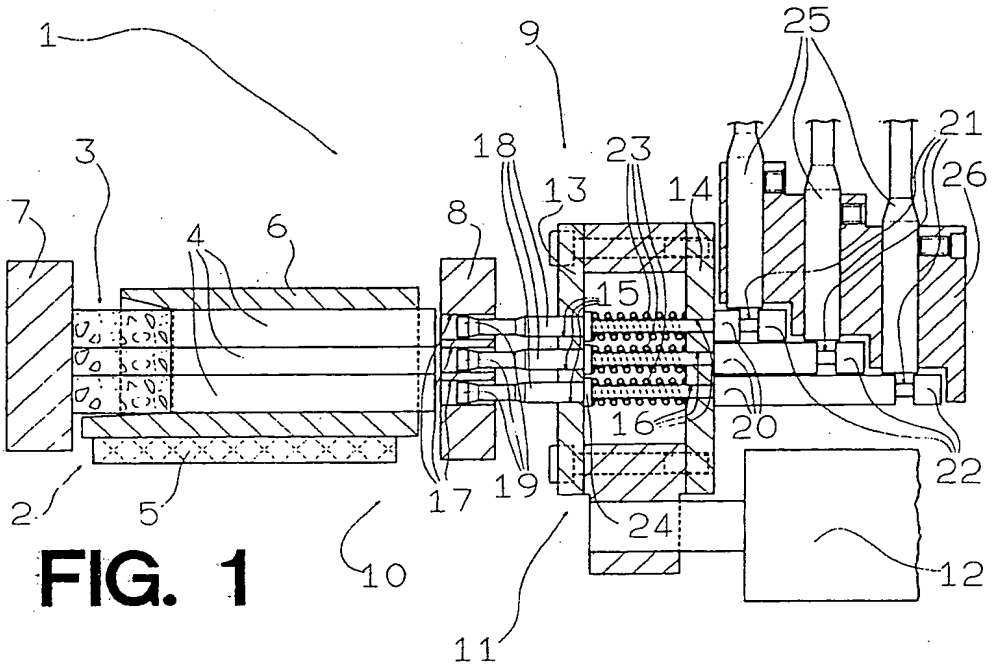

FIG. 1

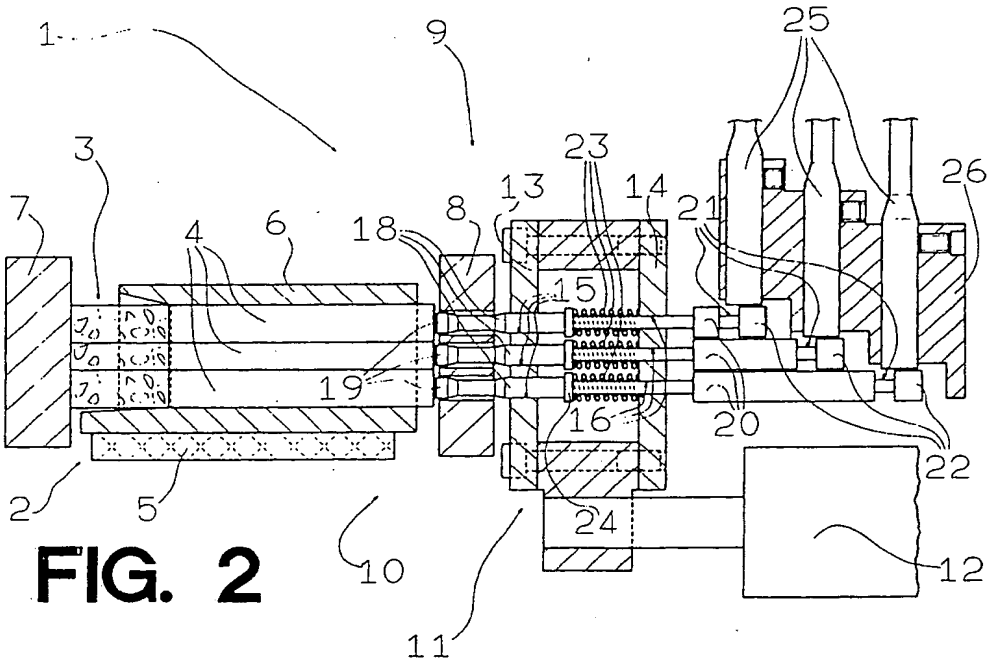

FIG. 2

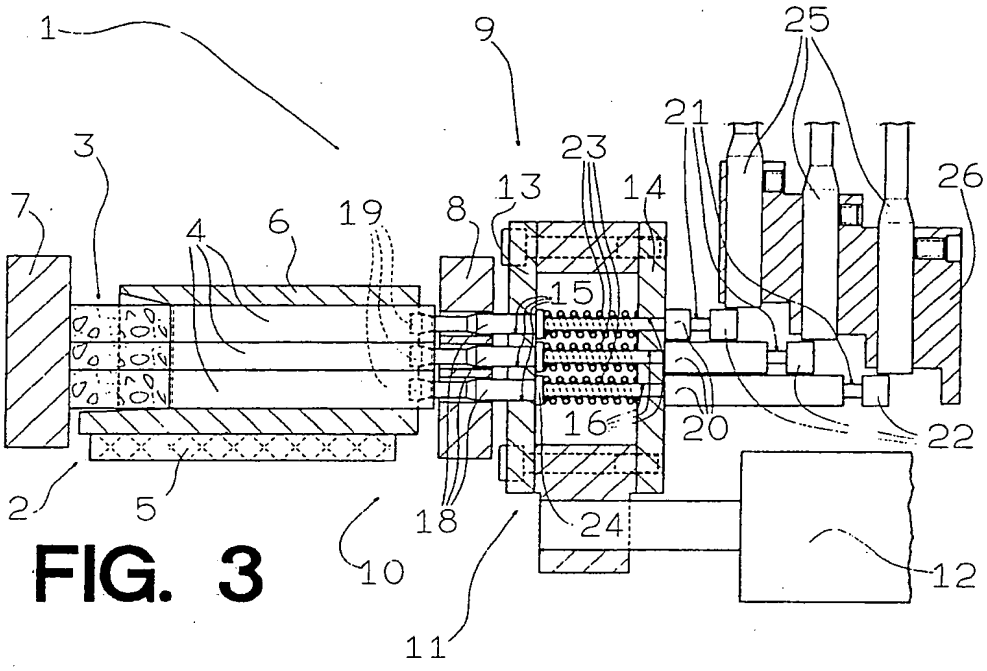
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FIG. 3

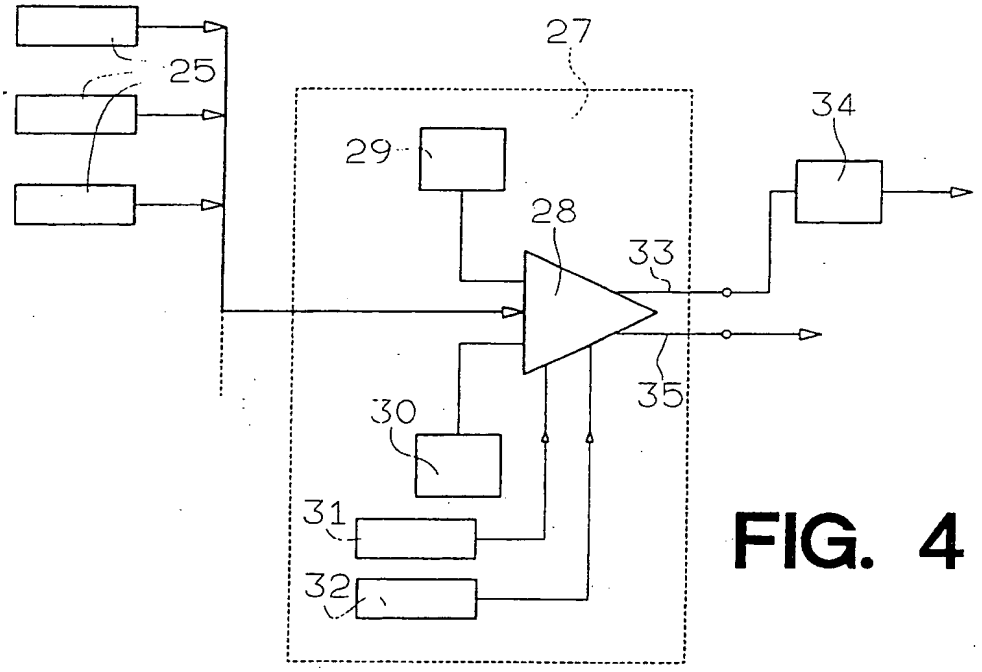
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FIG. 4

SPECIFICATION

Device for controlling groups of cigarettes on a cigarette packing machine

The present invention relates to a device for controlling groups of cigarettes on a cigarette packing machine.

On cigarette packing machines, the cigarettes are known to be fed through a feedbox having three outputs, each designed to form a flat layer of cigarettes. The said three layers are then fed successively into feed pockets on a jog conveyor, so as to form, inside each pocket, a group of cigarettes usually comprising twenty cigarettes arranged in three layers, one on top of the other, and constituting the content of one packet.

The cigarette groups so formed are than fed on to a wrapping wheel, before reaching which, however, they are usually checked as to completeness, i.e. to ensure all the cigarettes are present, properly filled and fitted with filters.

On known packing machines, the said control operation is usually performed by a group of pin feelers equal in number to the cigarettes in the group and arranged parallel with the same. When the said group of cigarettes is stopped by the said conveyor in a control station comprising the said pins, the latter are moved forward axially so as to contact the ends of the cigarettes facing them. Depending on the position of the pins subsequent to such axial displacement, each pin activates, or fails to activate, a switch button, activation of which indicates the presence and completeness of the respective cigarette. Non-activation of the said switch, on the other hand, results in a reject signal which, appropriately memorised, subsequently causes the entire group of cigarettes to be rejected.

A control station of the aforementioned type presents a number of drawbacks, due to the poor reliability of the said mechanical switches. Should even only one of the said switches fail to operate correctly, this could result in either non-rejection of incomplete groups, or, worse still, the rejection of a given number of complete groups. What is more, malfunctioning of one or more of the said switches is rarely detected immediately, with the result that the damage so caused may persist undetected for some time. On other known control stations, the said pin feelers and respective switches have been replaced by optical sensors, which, while eliminating the mechanical drawbacks of the aforementioned control station, are sensitive to variations in the colour of the tobacco with which the cigarettes are filled. Any change in the colour of the tobacco may, therefore, affect operation of the said optical sensors and, as in the previous case, malfunctioning of one or more sensors is not immediately detectable. The aim of the present invention is to provide a control device designed to overcome the aforementioned drawbacks, i.e. a device enabling reliable control of the completeness of the cigarette groups formed on the packing machine, as well as immediate detection of any operating faults on the device itself.

With this aim in view, according to the present invention, there is provided a device for controlling groups of cigarettes on a cigarette packing machine, said device comprising a number of pin feelers equal in number to and arranged in the same manner as the cigarettes forming the said group, and activating means connected to each said pin, via the interposition of elastic means, and designed to move back and forth in such a manner as to cause the said pin to move axially in reciprocating manner to and from the end of a respective said cigarette and between an operating position, wherein the said pin contacts the said cigarette, and an idle position, wherein the said pin is detached from the said cigarette; characterised by the fact that it also comprises a number of position sensors equal in number to and connected respectively to the said pins, and circuit means connected to the said sensors for supplying a first and second control signal as a function of the positions of the said pins in relation to the said sensors subsequent to each said forward and return movement respectively.

A non-limiting embodiment of the present invention will be described with reference to the accompanying drawings, in which :

Fig.1 shows a schematic view, in a first operating position, of a control device in accordance with the present invention;

Fig.s 2 and 3 show the Fig.1 device in a further two operating positions;

Fig.4 shows a block diagram of a circuit on the Fig.1 control device.

Number 1 in Fig.s 1, 2 and 3 indicates a cigarette packing machine comprising a jog conveyor 2 for groups 3 of cigarettes 4. The said conveyor 2 comprises a belt 5, the upper surface of which is fitted with a number of equally-spaced pockets 6. Each pocket 6 is designed to receive a respective group 3, and to step-feed it along an opening defined by two sides, 7 and 8, parallel with the traveling direction of belt 5 and perpendicular to the surface of the same.

Each group 3 usually comprises twenty cigarettes 4 arranged in three layers, one on top of the other, and forms the content of a packet (not shown) formed about the said group 3 on a wrapping line (not shown) downstream from conveyor 2.

Along conveyor 2, machine 1 presents a control station 9 in which a control device, indicated as a whole by 10, checks the completeness of groups 3 and subsequently provides for rejecting any faulty groups.

The said control device 10 is located facing

the opposite surface of side 8 to that facing conveyor 2, and comprises a frame 11 which, by virtue of an actuating means 12, is designed to move, in reciprocating manner, to and from the said side 8, between a forward operating position shown in Fig.s 2 and 3, and a retracted idle position shown in Fig.1. The said frame 11 comprises two walls, 13 and 14, spaced apart and parallel with side 8, and having respective numbers of through holes, 15 and 16, perpendicular to side 8. The said holes 15 and 16 are equal in number to and arranged in the same manner as cigarettes 4 in each group 3, and each hole 15 is coaxial with both a respective hole 16 and a respective hole 17 formed through side 8 and coaxial with a respective cigarette 4 in the group 3 in control staton 9.

Each pair of aligned holes 15 and 16 is engaged in axially-sliding manner by a respective pin feeler 18, the feeling head 19 of which projects from frame 11 in the direction of side 8 so as to engage in sliding manner a respective hole 17, and the tail end or detecting portion 20 of which is larger in diameter than holes 15 and 16, projects from frame 11 in the opposite direction to side 8, and presents, on its free end, an annular groove 21 defining an end block 22.

Each pin 18 is fitted with an elastic means consisting of a spiral spring 23 compressed between wall 14 and an annular projection 24 formed on pin 18 in the vicinity of wall 13.

As shown in Fig.s 1 to 3, displacement of frame 11 causes each block 22 to move past the end of a respective position sensor 25 which, in the example shown, is of the inductive type. The said sensors 25 are equal in number to pins 18 and supported, by a block 26, in a fixed position perpendicular to pins 18.

The said sensors 25 are designed to supply electric signals to circuit means comprising a control circuit indicated as a whole by 27 and, in turn, comprising a logic unit 28, generally an adding unit, having three inputs. The first of the said inputs is designed to receive the signals emitted by sensors 25; the second to receive a signal from a generator or unit 29 for emitting a control reference signal; and the third to receive a signal from a generator or unit 30 for emitting a self-diagnosis reference signal. Logic unit 28 is enabled for processing the output signals from sensors 25 according to a given control or self-diagnosis logic, and to take into account either one of the said reference signals, by an enabling signal supplied by an enabling signal emitter 31 or 32 connected to logic unit 28.

Operation of control device 10 will now be described starting from the idle position shown in Fig.1, and from when a group 3 of cigarettes 4 is arrested by conveyor 2 in control station 9.

When a group 3 is arrested in control station 9, actuator 12 is operated and emitter 31 issues a signal for enabling the control function of logic unit 28.

Operation of actuator 12 causes frame 11 to move towards side 8, hereinafter also referred to as the forward stroke, thus moving heads 19 gradually towards the ends of respective cigarettes 4 facing the said heads 19. Such displacement results in two possible operating conditions, as shown respectively in Fig.s 2 and 3.

In the Fig.2 condition, cigarettes 4 are all present and properly filled. Consequently, pins 18, which are pushed forward by frame 11, are arrested contacting the ends of respective cigarettes 4, and the final stroke portion of frame 11 compresses spring 23, and arrest of actuator 12 in the forward operating position activates both sensors 25 and generator 29.

As shown in Fig.s 1 and 2, the result of the aforementioned displacement of pins 18 is that each sensor 25, which was originally facing the void (Fig.1) defined by respective groove 21, is now located facing a solid (Fig.2) consisting of respective block 22. Sensors 25, therefore, all emit the same signal indicating the presence of a solid. At the same time, generator 29 emits a signal having the opposite sign to that of the signals emitted by sensors 25, and the intensity of which, e.g. minus a constant which may even be zero, equals the solid signal emitted by each sensor 25 multiplied by the number of sensors 25.

Logic unit 28 adds up all the incoming signals, and is designed in such a manner as to emit no output signal if, as in the case of the Fig.2 condition, the resulting sum equals the aforementioned constant. In the absence of an output signal from unit 28, operation of packing machine 1 remains unchanged.

Fig.3, on the other hand, shows an extreme case wherein all of cigarettes 4 are either badly filled (as shown), or missing, or lacking filters.

In this case, displacement of pins 18 is completed without compressing springs 23, with the result that each sensor 25, which was previously located facing a void (Fig.1), is moved, when respective pin 18 comes to a stop, into a position facing a further void behind respective block 22, and therefore emits a signal indicating the presence of the said void.

Should even only one of pins 18 find itself in the aforementioned position, the sum of the signals received by logic unit 28 no longer equals the aforementioned constant, and an error signal is emitted via a first output 33 on unit 28. The said error signal activates a reject memory 34 which, in known manner (not shown), subsequently provides for rejecting the said group 3.

At this point, actuator 12 is again operated for returning frame 11, in what is known as

the return stroke, to its original idle position as shown in Fig.1. The return of actuator 12 causes emitter 32 to emit a signal for enabling the self-diagnosis function of logic unit 28.

If pins 18 are all free, the return stroke of frame 11 resets pins 18 to their original position wherein each sensor 25 is located facing a void defined by respective groove 21, and emits a signal indicating the presence of the said void. At the same time, generator 30 emits a signal having the opposite sign to that of the signals emitted by sensors 25, and the intensity of which, e.g. minus a constant which may even be zero, equals the void signal emitted by each sensor 25 multiplied by the number of sensors 25.

Logic unit 28 adds up all the incoming signals and, as the resulting sum equals the said constant in the case of the Fig.1 condition, no output signal is emitted by unit 28 and operation of packing machine 1 remains unchanged.

Should even only one of pins 18 fail, for any reason, to return to its original withdrawn position, logic unit 28 emits an error signal via second output 35 and machine 1 is arrested. If such a provision were not made, malfunctioning of even only one of pins 18 could result in either acceptance of an incomplete group 3, or, in certain cases, in groups 3 all being rejected.

In the example embodiment described with reference to the accompanying drawings, sensors 25 are of the inductive type. The same performance, however, may obviously be obtained using capacitive sensors, or even optical sensors designed to detect different colour or absorption bands on pins 18.

Though, in the embodiment of the present invention as described and illustrated herein, self-diagnosis of device 10 is performed at the end of the said return stroke of pins 18, correct resetting of pins 18 to the said original withdrawn position, subsequent to controlling cigarettes 4, may be checked at any time during displacement of pins 18 by actuator 12. Correct positioning of the said solids and voids on pins 18 may obviously be detected by sensors 25 at any given time, even during displacement of pins 18, by simply providing, at the said given time, for emitter 32 to supply an enabling signal for enabling the self-diagnosis function of logic unit 28 and so comparing the signals emitted by sensors 25 and generator 30.

CLAIMS

1. A device for controlling groups of cigarettes on a cigarette packing machine, said device comprising a number of pin feelers equal in number to and arranged in the same manner as the cigarettes forming the said group, and activating means connected to each said pin, via the interposition of elastic means, and designed to move back and forth in such a manner as to cause the said pin to move axially in reciprocating manner to and from the end of a respective said cigarette and between an operating position, wherein the said pin contacts the said cigarette, and an idle position, wherein the said pin is detached from the said cigarette; characterised by the fact that it also comprises a number of position sensors equal in number to and connected respectively to the said pins, and circuit means connected to the said sensors for supplying a first and second control signal as a function of the positions of the said pins in relation to the said sensors subsequent to each said forward and return movement respectively.

2. A device as claimed in Claim 1, characterised by the fact that each said pin presents a detecting portion comprising a void and a solid arranged side by side, the said void being defined by a sunken portion of the said pin; each said sensor being assigned to the said detecting portion of a respective said pin, and being designed to supply the said circuit means with a signal depending on the presence, in front of the said sensor, of the said solid or the said void.

3. A device as claimed in Claim 1 or 2, characterised by the fact that the said circuit means comprise a logic unit connected to the said sensors and designed to process the output signals from the same according to a first control logic and a second self-diagnosis logic, and to emit the said first and said second signal respectively.

4. A device as claimed in Claim 3, characterised by the fact that the said circuit means comprise a unit for emitting a reference signal for each said operating logic; the said logic unit comprising a block for adding the said output signals from the said sensors and the said reference signal.

5. A device for controlling groups of cigarettes on a cigarette packing machine, substantially as described and illustrated herein with reference to the accompanying drawings.

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